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ABSTRACT

Consumer education has always been a primary consideration in the prevention of food-borne illness. Using nutrition education and the new food guide as a model, this paper develops suggestions for a framework of microbiological food safety principles and a compatible visual model for communicating key concepts. Historically, visual food guides in the United States have concentrated on dietary recommendations, including the well-known pyramid of food classification and the mandatory nutritional labeling. Guides are now emerging for food safety education and public health. For example, the United States Department of Agriculture (USDA) recently made safe handling labels required on all raw and partially cooked meat and poultry products. The Hazard Analysis Critical Control Point (HACCP) is a procedure that identifies ways to prevent food-borne illness by monitoring critical control points in the processing of foods. In other words, the consumer should take certain precautions at each culinary step, including when food is purchased, stored, prepared, cooked, and when the preparer cleans up. These consumer tools need more systematic presentation, however. Dietary recommendations can be grouped under the three points of variety, proportionality, and moderation; food safety principles are also governed by threes--the three variables of time, temperature, and cleanliness and three categories of food which represent different degrees of bacterial risk. Any accompanying visual model should use familiar but strong symbols (a clock, a thermometer, hands under a faucet) and careful manipulation of design variables like shape and line. Seven figures accompany the text. (Contains 11 references.) (BEW)

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Consumer Control Points: Creating a Visual Food Safety Education Model for Consumers

Carole B. Schiffman

Each year, foodborne disease causes millions of consumers in the United States to become ill (Archer and Kvenberg, 1985). As populations at greater risk increase (e.g., the elderly and immunocompromised patients such as those with AIDS or cancer) even these enormous numbers may rise. Food safety experts, therefore, continue to search for ways to avoid new cases of foodborne illness.

Consumer education has always been a primary consideration in the prevention of foodborne illness. Although microbes present the greatest food safety risk to consumers, they also offer the greatest opportunity for risk control. Consumers, however, must learn how to control such food safety risks. To meet this informational need, food safety educators must be provided with effective communication tools.

Current microbiological food safety education for consumers consist of a smattering of disconnected recommendations, guidelines, and points, all of which have resulted in poor communication. To carry out effective and consistent education, a framework of microbiological food safety principles must be developed, and a compatible, visual model must be designed to communicate these key concepts. This model would serve as an educational tool to visually describe basic food safety principles to consumers.

Using nutrition education and the new food guide as a procedural model, this paper offers a framework of microbiological food safety principles for the development of an informational graphic for consumers. Through this visual device consumers would be provided with a logical means to comprehend, file, store, and retrieve food safety messages for practical use and application.

Food Guides and Guidelines

Historically, food guides in the United States have translated dietary recommendations into simple nutrition education tools useful to consumers in improving and controlling their dietary intake and behavior (Light, 1981). Food guides have provided a conceptual framework for selecting the types and quantities of foods which together provide a nutritious diet (Welsh et al., 1992a). Overall, they allow foods to be classified

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and categorized for easy memory storage and practical use to suit dietary needs.

The new Food Guide Pyramid (Fig. 1), developed by the U.S. Department of Agriculture (USDA), is the latest attempt at communicating the principles of a balanced diet using a single visual device. With its triangular facade exhibiting separate compartments for each food group (bread, cereal, rice, and pasta; fruits; vegetables; milk, yogurt, and cheese; meat, poultry, fish, beans, eggs, and nuts; and fats, oils, and sweets), the Pyramid serves as a structured menu from which we are to select a healthful diet. It identifies relative amounts of each food group to be eaten each day, with the core of the diet located within the foundation or base, the largest area of the structure. Room for personal preferences, activity differences, and physical variation is acknowledged and allowed through ranges of servings, indicated outside the image. Recipe variations and differences in methods of preparation are reserved for more detailed companion materials.

This information-bearing graphic communicates the broad message of a balanced diet through the relative visual size and placement of food groups within the image. The basis of the Pyramid's broad messages is the Dietary Guidelines for Americans, developed by USDA and the Department of Health and Human Services in 1990 (Fig. 2). These guidelines contain seven principal statements reflecting current consensus on the most important dietary measures associated with reducing the risk of chronic disease in America: 1) eat a variety of foods; 2) maintain a healthy weight; 3) choose a diet low in fat, saturated fat, and cholesterol; 4) choose a diet with plenty of vegetables, fruits, and grain products; 5) use sugars only in moderation; 6) use salt and sodium only in moderation; and 7) if you drink alcoholic beverages, do so in moderation.

Together, the Dietary Guidelines and the new Food Guide Pyramid provide consistency of communication, with all nutrition messages relating back to one framework. The messages are repeated for reinforcement by using the same language.

Figure 1.
Food Guide Pyramid

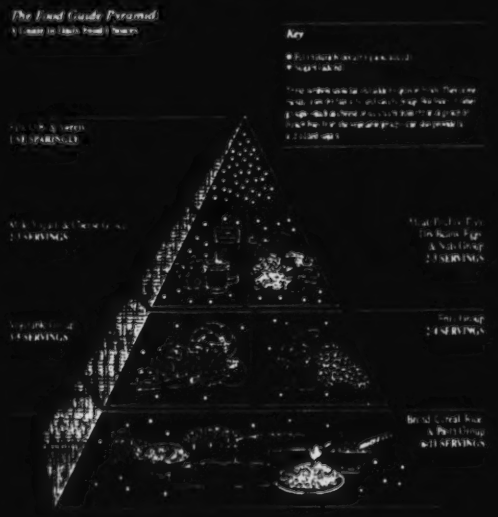

Figure 2.
USDA/DHHS
Dietary Guidelines for Americans

- Eat a variety of foods
- Maintain healthy weight
- Choose a diet low in fat, saturated fat, and cholesterol
- Choose a diet with plenty of vegetables, fruits, and grain products
- Use sugars only in moderation
- Use salt and sodium only in moderation
- If you drink alcoholic beverages, do so in moderation

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and are presented within a strong, memorable, meaningful visual device.

To assist consumers further with information and education relating to dietary management, the U.S. Food and Drug Administration (FDA) proposed mandatory nutrition labeling for all processed food products. As another communication device enabling consumers to control their health through food use, and indirectly as an educational tool, the agency developed a new food label graphic (Fig. 3). The label is carefully designed to be a highly legible table of critical nutritional information, such as caloric content, fat, cholesterol, and sodium. The new design readily communicates nutritional information relevant to the food product within the labeled package. In a sense, the food label provides usage instructions, offering information on how the consumer may apply the individual food to a healthful diet.

In other words, the Dietary Guidelines provide a framework of nutritional messages for all foods, and the Food Guide Pyramid offers a visual storage device for these messages from which the principles of a balanced diet may be stored, retrieved, and applied by the consumer, as needed. The new food label further specifies nutritional usage information by relating a particular food item within the diet to the Dietary Guidelines and Food Guide Pyramid.

Figure 3.
New Food Label

Nutrition Facts

Serving Size ½ cup (114g)
Servings Per Container 4

Amount Per Serving

Calories 90	Calories from Fat 30
	% Daily Value*
Total Fat 3g	**5%**
Saturated Fat 0g	**0%**
Cholesterol 0mg	**0%**
Sodium 300mg	**13%**
Total Carbohydrate 13g	**4%**
Dietary Fiber 3g	**12%**
Sugars 3g	
Protein 3g	

Vitamin A	80%	Vitamin C	60%
Calcium	4%	Iron	4%

* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

	Calories	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Fiber		25g	30g

Calories per gram:
Fat 9 • Carbohydrate 4 • Protein 4

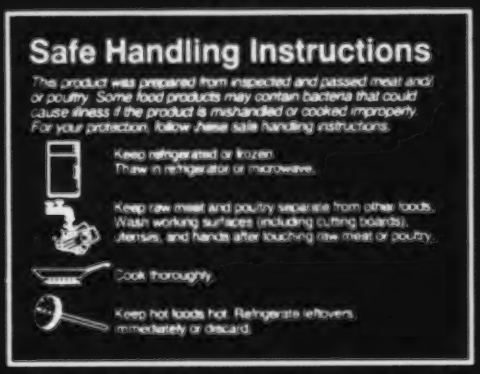
Food Safety Education

Although applied to the nutritional aspects of food since 1894 (Welsh et al., 1992a), such a comprehensive and cohesive approach to food education has never been formally applied to food safety in the United States. However, as a result of recent tragic outbreaks of foodborne illness (MMWR, 1993), consumer interest in microbiological food safety and interest by public health agencies in consumer education have both increased.

The USDA recently required safe handling labels to be placed directly on all raw and partially cooked meat and poultry products (Fig. 4). For the first time, a discrete number of critical microbiological

food safety concepts are clearly identified and graphically displayed on this meat and poultry safe handling label. Four symbols are present with simple instructions: 1) an illustration of a refrigerator, carries next to it instructions to keep the product refrigerated or frozen, and to thaw in the refrigerator or microwave; 2) a drawing of soapy hands under a faucet, carries instructions to keep raw meat or poultry separate from other foods and to wash work surfaces, utensils, and hands after touching raw meat or poultry; 3) a frying pan symbol states, "cook thoroughly"; and 4) a drawing of a thermometer indicates that hot foods should be kept hot and leftovers should be refrigerated immediately.

Figure 4.


Safe Handling Instructions
This product was prepared from inspected and passed meat and/or poultry. Some food products may contain bacteria that could cause illness if the product is mishandled or cooked improperly. For your protection, follow these safe handling instructions.
Keep refrigerated or frozen. Thaw in refrigerator or microwave.
Keep raw meat and poultry separate from other foods. Wash working surfaces (including cutting boards), utensils, and hands after touching raw meat or poultry.
Cook thoroughly.
Keep hot foods hot. Refrigerate leftovers immediately or discard.

HACCP-based educational brochure on safe food hadling, prepared for consumer use.

This safe handling label represents a significant step toward developing a cohesive set of food safety educational tools. It parallels the new nutritional food label by providing specific instructions on the use of the particular product which bears the label. Still needed for food safety education, however, is a consensus on broad microbiological food safety principles, or the equivalent of the Dietary Guidelines. In addition, a companion informational graphic, such as the Food Guide Pyramid, is needed to encompass and reflect these principles as they relate to all foods.

Hazard Analysis Critical Control Point Program

The Hazard Analysis Critical Control Point (HACCP) program is rapidly gaining wide popularity within the food industry. Applied to various segments of the industry since the early 1970s, HACCP provides a framework for implementing preventive measures where the failure to control a critical point of control can lead to an increased food safety risk (NACMCF, 1992). HACCP is based on fundamental principles of food safety, just as the Dietary Guidelines capture the principles of a healthful diet.

Researchers have proposed that the most effective use of HACCP for food safety would include its utilization not only throughout production, but application also in the home (Beard, 1991; Ward, 1993). HACCP is a seven-step systematic procedure that provides for identification of and preventive measures to control foodborne hazards by monitoring critical control points in the processing of foods. This approach is more complex than the consumer needs to implement at home for a good level of safety. However, an abbreviated version of HACCP could be applied in the home, using the concept of food safety guidance and a simplified version of critical points, such as holding temperature and careful handling of foods.

The booklet *A Quick Consumer Guide to Safe Food Handling* (USDA, 1990b) (Fig. 5) suggests the application of HACCP principles in the home. Recommendations are presented in standard textual format under approximately ten subheadings, which could be consolidated

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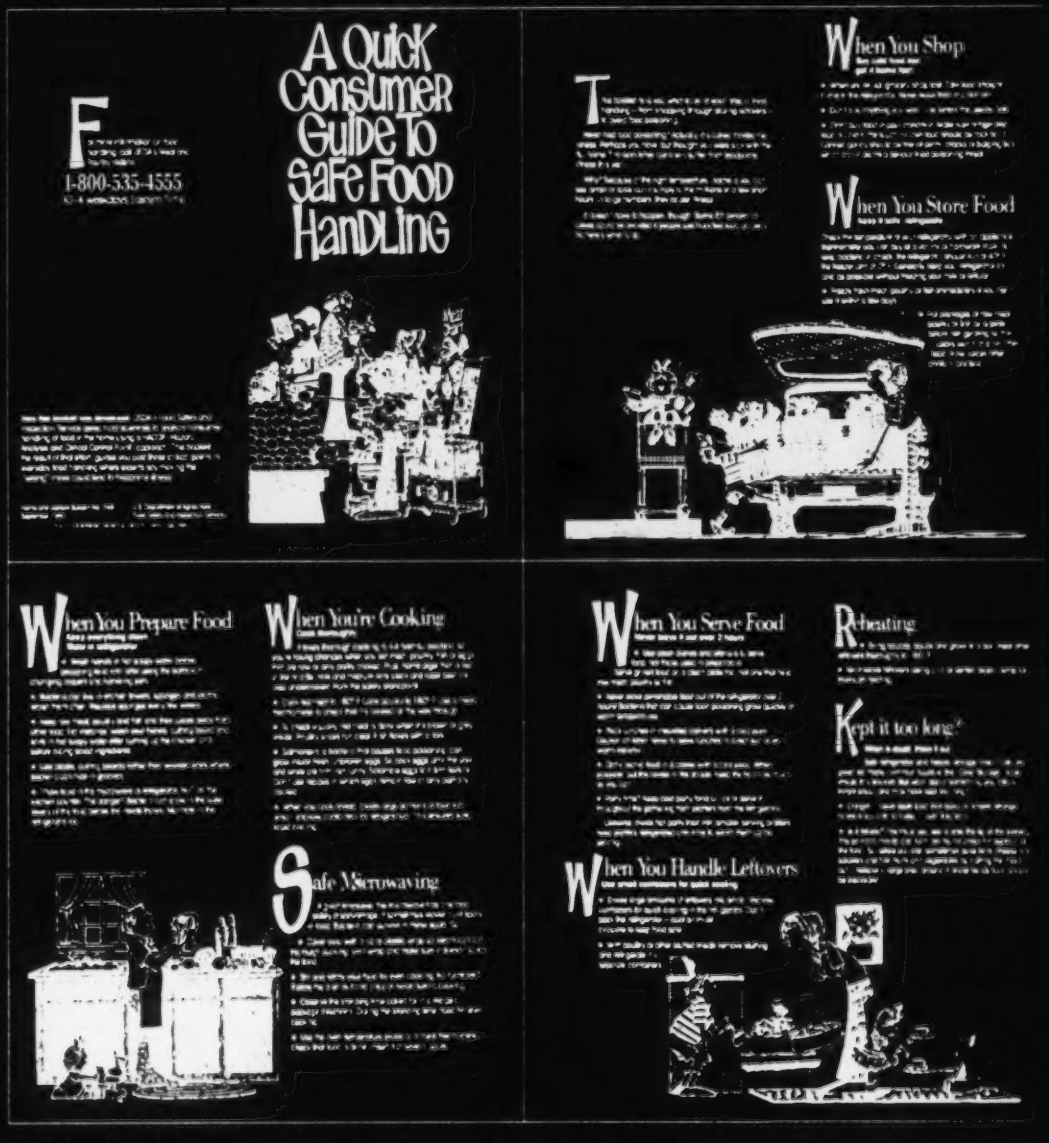
into a HACCP-based framework of broad principles. The meat and poultry safe handling label represents a first step in consolidation of these principles.

Redisigning the Verbal Before the Visual

As a conceptual starting point for development of a framework of food safety principles, HACCP could be redesigned into a more user-friendly concept for consumers. By reconstructing the terms used for the acronym, we can focus on what we are trying to communicate: that consumers need to take control of their food products and practices in the home, and that at certain points this is control is critical. We can then describe "who" (the consumer)

Figure 5.
New USDA Meat and Poultry Safe Food Handling Label



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and "what" (control points) Consumer Control Points (CCP) (J. Rhodehamel, FDA, personal communication, 1992). This simplified, less intimidating, friendlier term may be easier to market.

"Do you know your
"Consumer Control Points"?

"Consumer Control Points:
You're in Control."

Consumer Control Points (CCP) can provide an umbrella for consumer food safety messages, which would be reflected within a single microbiological food safety graphic.

Developing a Framework

The scientific community has not yet established broad microbiological food safety principles for consumers, although some guidelines have been suggested. *A Margin of Safety: The HACCP Approach to Food Safety Education* (USDA 1990a), contains five critical control points (and a "red light, yellow light" system to denote essential and advised behaviors): 1) acquisition, 2) home storage, 3) preparation, 4) serving, and 5) handling. Although the emphasis is on meat and poultry products, it may be broadened to include all food products. A similar classification of Consumer Control Points, or the points at which microbiological hazards are likely to occur in the home might be defined as follows:

- *Purchasing.* Check containers for damages; check "sell by" dates; transport quickly.
- *Storing.* Refrigerate perishables promptly after purchasing; refrigerate leftovers promptly in shallow containers.
- *Preparing.* Thaw foods in the refrigerator or the microwave; do not cross-contaminate raw foods with cooked foods.
- *Cooking.* Cook foods thoroughly; reheat foods thoroughly.
- *Cleaning.* Wash your hands well; rinse produce; keep work surfaces clean.

These five points are broad enough to be comprehensive, yet few enough in number to remember.

Key Concepts

If the approach used for developing the food guide graphic is followed, the Consumer Control Points, or food safety guidelines, must be synthesized into key concepts. For example, the seven Dietary Guidelines for Americans were organized into three key concepts: variety, proportionality, and moderation. These became the broad communication messages of the Food Guide Pyramid (Welsh et al., 1992b). They were then used to determine the graphic requirements.

- *Variety.* Present six categories, or groups of food. Grains; fruits; vegetables; milk, cheese and yogurt; meat, poultry, fish, dry beans, eggs and nuts; fats, oils and sweets.
- *Proportionality.* Present the relative amounts of the various food groups to be eaten daily and the range in the number of servings to be eaten within food groups.
- *Moderation.* Indicate the need to moderate intake of fat and added sugars within the total diet (Welsh et al., 1992b)

Our five microbiological food safety Consumer Control Points may be conceptually expressed as time, temperature, and cleanliness. In a different order of classification, the concept of

relative risk puts the three concepts into context by telling when they are more or less critical. Where time, temperature, and cleanliness reflect functions that are controlled by the consumer, relative risk reflects properties of the foods that affect these functions. Compatible graphic requirements for the food safety visual would be represented as follows:

These symbols used to denote key concepts include: hands under a faucet to denote cleanliness; a clock with a moving arrow spanning two hours to denote time; and a thermometer to denote temperature, with a middle range "danger zone" for food handling, where bacteria grow best (40 to 140°F) shaded for cooking and refrigeration temperatures. The concept of relative risk is emphasized through relative size and location of the symbol compartments and the food groups. Stronger symbols and careful manipulation of design elements and variables, such as line, value, shape, and size should ultimately yield a more effective model.

Time	Temperature	Cleanliness
Indicate that time is a critical factor in the relative safety of food, e.g., refrigerate leftovers promptly; buy perishables last; check "sell by" dates; teme is a factor in thorogh cooking	Indicate that temperature is a critical factor in food safety, e.g., cook thoroughly; refrigerate promptly do not hold foods in the "danger zone"; temperature is a factor in thorough cooking.	Indicate that hygiene and cleanliness are critical factors in food safety, e.g., wash hands, keep eqquipment and workspaces clean, and avoid cross-contamination.

Relative Risk		
Indicate that different levels of risk are associated with the susceptibility of different types of foods to various bacteria or pathogens, grouped here into three categories:		
Animal Proteins: (e.g., meat, poultry, seafood, eggs, milk, cheese), carry the greatest potential microbiological hazard, or require more attention with regard to safety.	Dry Foods: (e.g., dry cereals, pretzels, crackers), carry a low level of potential hazard or risk.	All Other Foods: Carry a moderate, or medium level of risk or potential hazard (e.g., fruits, vegetables, beans, potatoes).

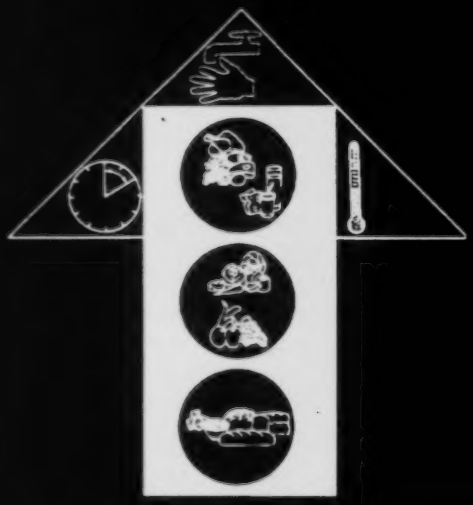
Visual Model

Based on these key concepts, the following initial attempts were made to capture and reflect them within a visual food safety education model. While they may not represent the best solution, they offer a starting point for other educators and information designers to build upon. Continuous focus group testing throughout the development of a graphic would help to create the most effective, communication messages and devices.

The visual model represented by the traffic signal image (Fig. 6) contains three circles stacked within a vertical rectangle. The cleanliness, time, and temperature

symbols surround the rectangle within triangular compartments located near the more risky food group, animal proteins, and touching the moderately risky group in the middle. Even without color, starting with the top circle, this image indicates red (danger or high hazard), yellow (proceed with caution), and green (proceed in a safe manner). The group of foods with the highest potential hazard is contained within the red circle; those of moderate risk, within the yellow circle, and those of lesser risk, within the green circle.

Figure 6.

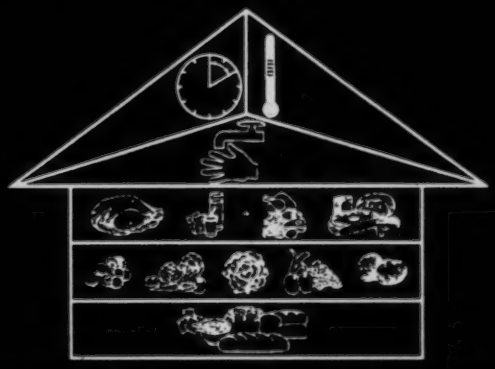


Traffic signal image containing food groups within the red, yellow, and green circles is combined with triangular canopy displaying key microbiological food safety concepts.

A benefit of this device is that because of the consumer's familiarity with the meaning of the symbol, messages can be conveyed in black and white as well as color. A drawback would be the possibility of miscommunication of messages, e.g., the red circle might imply that consumers should stop eating animal proteins or that these foods are bad in and of themselves.

Figure 7, shaped like a house, contains three tiers of risk: the top being the highest risk. The three food safety symbols are displayed within the triangles of the roof, covering all groups, and resting directly on the more risky group. Although the shape of the house communicates nothing about risk, it indicates that this information is for use within the home.

Figure 7.



House-shaped image combines three tiers of food safety risk with a traingular roof containing three microbiological food safety symbols.

General challenges include the need to communicate the concept of time and temperature as factors without stating a specific time or temperature such as 2 o'clock, 2 hours, or 145 degrees. Also, in a graphic that incorporates more than one message symbol, all message should be either positive or negative to avoid inconsistency in communication and resultant confusion.

The overall goal of using other food guidance systems has been "for the intended audience to be able to understand, remember and effectively use the system" (Cronin et al., 1987). Generally, the graphic should be as easy to reproduce in black and

white as in color, and should still be readable after reduction.

Identifying appropriate messages for a HACCP-based framework and compatible, communicative images is a long process that faces many challenges. New and different issues are sure to surface with focus group testing. Meanwhile, with each challenge, we are brought that much closer to an effective solution.

Conclusion

Unlike nutrition education, which comprises a comprehensive collection of integrated tools, microbiological food safety education for consumers currently consists of a smattering of recommendations and guidelines. Such food safety education for consumers needs to be presented within a systematic framework, preferably based on the increasingly popular concept of HACCP, which could serve as a classification system for food safety principles and recommendations. A useful, effective, and memorable visual model needs to be developed to reflect these food safety principles so that consumers can learn and remember their role and take responsibility for microbiological food safety in the home. These tools will enable educators to speak as though with one voice, and more effectively and consistently communicate to consumers the critical public health principles of food safety.

The views expressed in this paper are the author's and do not necessarily represent those of the Food and Drug Administration.

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